# The ins and outs of singing

Most air-breathing vertebrates have exploited the mechanisms required for this process as a way of making sounds. But almost all the noise is produced while breathing out so that up to half of the breathing cycle is not used. A few amphibians are known to use the inspiratory phase of breathing, rather than expiration, to make sounds but there is little evidence that other animals have been able to use both parts of the cycle for vocalisation. In humans, the only examples appear to be a particular clicking sound in just one African language.

However, new work recently published by Franz Goller and Monica Daley at the University of Utah (Proc. R. Soc. Lond. B *268*) suggests that the Australian zebra finch (*Taeniopygia guttata*) may have acquired the ability to sing while breathing both in and out.

The researchers studied two groups of juvenile male zebra finches. Using delicate canuli and minute detectors attached to the birds which produced a correlate of air pressure and air flow in the trachae and air sacs while singing, the researchers found syllables in the bird's song which appeared to be produced during the inspiratory phase of the breathing cycle. These sounds also appear acoustically distinct.

The normal song comprises three to seven expiratory pulses separated by short inspirations (minibreaths) but the new work shows that some of these minibreaths are used to produce sounds.

The researchers further tested the birds by exposing one group of juveniles only to a computer-edited tape of adult male song. Juveniles use adult songs to help develop their own songs. The normal song was manipulated so that inspiratory sounds were interposed within expiratory positions in the song. Out of nine birds tutored in singing by the tape, eight incorporated inspiratory sounds into their song while copying only 9–44% of the entire song motif. All the inspiratory sounds were, however, produced during inspiration, regardless of where they had appeared in the computer-generated song created by the researchers.

There's growing evidence that female song-birds prefer males able to sing more complex songs so perhaps zebra finches have hit upon a novel and long-unexploited mechanism to help achieve that goal.

**Breath control:** zebra finches may be able to sing breathing in and out . Photo: Oxford Scientific Films.